

## Steam Sterilizer Basics

### *Principle of Operation*

While there are a number of different kinds of sterilizers available for use in medical facilities, the most frequently used type in local health departments is the steam autoclave. This is a metal chamber with an airtight seal, a source of steam (usually a water reservoir), a heating element, and a timing device. Items placed in the chamber are subjected to hot steam under pressure for time cycles that vary according to the type of item being sterilized. Adequate heat and steam pressure for the recommended length of time should result in the complete destruction of any microorganisms and their spores. Steam autoclaves are sold in a wide range of sizes and with varying degrees of programmable functions.

### *Safety/Physical Concerns*

When loading the autoclave with contaminated items, it is prudent to wear a labcoat and gloves as you would with any potential exposure to biohazards.

When the autoclave cycle is finished, keep exposed skin away from the door as it is opened. Remove items from the autoclave wearing a labcoat and using something to protect hands from heat (special gloves or hot pads.)

Steam under pressure is inherently dangerous. Major maintenance of the autoclave should only be performed by trained service technicians. The autoclave should be situated in an area where traffic is kept to a minimum. Only health department staff, never clients or children, should have access to the area where the autoclave is running. The autoclave should only be operated by trained personnel, following all manufacturers' instructions. A strict schedule of maintenance should be followed, again as recommended by the instrument manufacturer.

The area where the autoclave is situated should be properly vented, as the release of water vapor after the sterilizing cycle results in increasing humidity.

For this reason, the testing area of the laboratory is not the best place for an autoclave, since many lab test functions require humidity control.

### *Operational Checks*

Always refer to the manufacturer's Operator's Manual for specific instructions regarding use, maintenance or troubleshooting problems with your autoclave. The website [www.sterilizers.com](http://www.sterilizers.com) has manuals on-line for most models sold in the United States, as well as a list of troubleshooting guides provided by each different manufacturer. This is an excellent source for replacing lost manuals.

The desired result after autoclaving is that the proper conditions have been achieved to assure sterility. To verify this, a biological monitor is required. Indicators such as autoclave tape that darken in color are not sufficient because they are heat activated and do not verify that the steam pressure was adequate. Autoclave tapes and other heat indicators are best used to distinguish between items waiting to be autoclaved and those that have already been autoclaved.

Biological monitors consist of strips or ampules containing spores of a heat-resistant bacillus (generally *B. stearothermophilus*). These organisms will survive autoclaving unless the steam pressure is adequate for a minimum of 15 minutes. One biological monitor is autoclaved with the load to be checked, then incubated at 56° C for 48 hours. Bacterial growth is usually indicated by a color change in the growth medium, and the color change would signal that the items in the load might not be sterile. The Centers for Disease Control (CDC) recommend once weekly biological monitoring of all autoclaves. Alternately, the College of American Pathologists recommends biological monitoring of each load. Obviously, autoclaved items should not be used until the biological monitor test is completed.

Biological monitors are available from most medical and lab supply distributors. In some cases you send the spore ampule to the company to be incubated for you, with positive reports phoned in immediately. Some come with a small incubator so that you can complete the testing onsite.

### Record Keeping

In general, there are some basic operational functions that should be documented. An autoclave log should be maintained and the following information recorded.

#### Each run:

Check and record the maximum temperature achieved during the autoclave cycle. The temperature should be 121° C.

Check and record the length of time the load was processed at temperature. Timing should not begin until the proper temperature has been reached.

Check and record the steam pressure shown on the autoclave gauge. Proper pressure throughout the timing cycle is approximately 15 pounds per square inch (psi).

The autoclave thermometer should be checked with a certified thermometer periodically. Be sure to use a certified thermometer especially made to withstand the autoclave pressure.

### Routine Cleaning and Maintenance

It can't be said too often that you must follow the instructions for cleaning and routine maintenance as provided to you by the manufacturer of your particular autoclave. The following are suggested actions for autoclaves in general. Review your operators' manual for equivalent instructions. Devise a checklist for your autoclave log that incorporates all these actions so that you can record when and by whom they have been performed.

Each day of use, check the filter or "plug screen" on the water flow that keeps foreign matter from entering the autoclave. The danger here is that the chamber discharge system (venting and water drainage) will become clogged.

Check the water reservoir level prior to each run.

Check the door gasket every three months for steam leaks while the autoclave is fully pressurized.

Clean the interior and exterior of the autoclave thoroughly every three months, using only cleaning materials approved by the manufacturer.

Check the following every three months for any visible sign of wear: door hinges and general door structure, exterior structure, chamber drain (should completely drain within 3 minutes), slow exhaust (should completely vent between 12 and 20 minutes), fast exhaust (three minutes maximum), timer ( $\pm 10\%$  of setting.)

Some users prefer to enclose particularly messy items in autoclave bags. Be sure to use a high-quality bag and follow the instructions for sealing it. There are reports of poor quality bags bursting during the autoclave cycle, creating an even bigger mess.

### Load-Specific Timetable

At 121° C and 15 psi, the following times are recommended:

Fabric	$\geq 3$ minutes
Wrapped hard goods	20 minutes
Unwrapped hard goods	$\leq 15$ minutes
Liquids	1 hour per gallon
Trash and glassware	1 hour

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#### References:

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